

Idaho Department of Fish and Game Region 6 Idaho Falls, ID

M E M O R A N D U M

1 August 1990

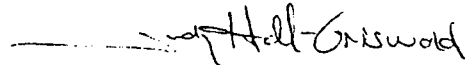
FROM: Judy Hall-Griswold

TO: Bill Schrader, Bruce Rieman, Inez Hopkins and Cleve Steward

SUBJECT: Sockeye Salmon

Due to the many requests for the information on sockeye which has been recently compiled, I am enclosing copies of the report for your files. Inez Hopkins will be placing a copy of this report in the Fish and Game library. Please note that the information complies with the request made by the National Marine Fisheries Service for information on sockeye and kokanee in the Stanley Basin. Other information may exist on sockeye which is not within the focus of this report.

Sincerely,

A handwritten signature in dark ink, appearing to read "Judy Hall-Griswold", with a horizontal line extending to the left.

Judy Hall-Griswold  
Fishery Research Biologist

Idaho Department of Fish and Game  
13 July 1990  
SOCKEYE OF STANLEY BASIN  
SUMMARY

Prepared by  
Judy A. Hall-Griswold

1. Historical records of sockeye distribution and abundance in the Salmon River Basin.

a. harvest (recreational, commercial, tribal)

(Evermann, 1895)

In 1881, 1,180 kg of sockeye were harvested from Alturas Lake for mining camps. Plans were made at one time to build a cannery at Redfish Lake to process the sockeye catch.

Two fisheries were run for 7 or 8 years at Big Payette Lake for redfish between 1870 and 1880. The fisheries were run by Hughes and Bodily, and Louis Fouchet. One year Hughes and Bodily put up about 75,000 fish. They quit fishing in 1876, no one fished in 1877, but in 1878 Fouchet came back and fished for 1 or 2 more years. Mr. N.B. Robertson reported Louis Fouchet use to come to Payette Lake 15-20 years previous and salt down 30,000 to 40,000 lbs. of redfish every year. Mr. Robertson recalled both large and small (6-8") redfish in Big Payette Lake.

(Marie Sullivan, Personal Communication, Challis, ID)

Mrs. Sullivan recalls that during the year of her wedding, 1937, her husband caught sockeye in the main Salmon River near Stanley, ID.

(Craig Rember, Personal Communication, Stanley, ID)

Mr. Rember observed and caught sockeye salmon in the late 1930's and early 1940's in Redfish Lake. The sockeye ranged in size from 5 to 7 lbs.

(Idaho Department of Fish and Game files)

The Idaho run of sockeye salmon contributes between 0.5 and 1.0% of the Columbia River run. The Columbia River commercial fishery reaps most of the economic benefits from this run.

(Bjornn et al, 1968)

From 1955-1964, the number of adults returning to the Redfish Lake Creek weir appeared to be regulated somewhat by the commercial fishery harvest in the lower Columbia River. Also, since the commercial fishery was

selective to larger fish and few of the Redfish Lake fish are small, the fishery may have taken a disproportionately large share of the fish destined for Redfish Lake.

(Pollard, Aug. 1983)

Pollard (1983) reported the illegal harvest of one (20 inch) male sockeye from Redfish Lake Creek in 1983.

b. surveys (spawning ground, juvenile and adult sampling)

(Evermann, 1895)

Evermann (1895) reported sockeye salmon in Alturas, Pettit, Redfish and Stanley Lakes during his survey of the Stanley Basin in 1895. An account of adult redfish in Alturas Lake was given by Mr. F.C. Parks who reported 2 distinct sizes of redfish, those of one size weighing 3 or 4 lbs., while those of the other size weighing less than half a pound. Mr. Parks reported fish of both sizes entering Alturas Lake on August 1 and reaching the inlet by August 5 to spawn. The small and large ones nearly always schooled separately. The small ones spawned about 3 miles up the inlet, and the larger ones spawned in the lower part of the inlet. Spawning usually went through the 1st of September. Redfish up to 6 lbs. had been reported.

Another report by Mr. B.S. Brown recalled big redfish spawning around August 18, 1893, and around August 15 in 1887, 1888 and 1889 in Alturas Lake. The large ones averaged 3-4 lbs. Both Mr. Parks and Mr. Brown recalled more male sockeye than female sockeye.

Evermann also noted that Redfish occurred in the Big Payette Lake, but were not known to occur to enter Little Payette Lake. Mr. W.C. Jennings recalls a large abundance (in the millions) of redfish in former years in Big Payette Lake. They appeared about August 10-15 each year and continued to be seen up to the last week of October. The principle spawning beds were in the inlet of Big Payete Lake, 2-3 miles above the lake. But they went as far as 5-6 miles. He also reported both large (4-5 lbs) and small sockeye (probably kokanee).

(Parkhurst, 1950)

Reported 200 sockeye spawning in Redfish Lake in 1942.

(Craig Rember, Personal Communication, Stanley, ID)

Mr. Rember observed sockeye spawning in Redfish Lake during the late 1930's and early 1940's (ie., post-

Sunbeam Dam). He reported seeing good runs of several hundred in 1945 and 1947.

(Morgan Williams, Personal Communication, Challis, ID)

Mr. Williams father settled in Stanley Basin in 1900. Morgan remembers his father telling him that the sockeye were so thick then, that the horses would not cross the streams where the sockeye were spawning.

(Bill Sullivan, Personal Communication, Clayton, ID)

Bill Sullivan moved to Stanley in 1937 and was a hunting and fishing guide, however, during earlier trips to Stanley, he observed sockeye and chinook salmon ascending the ladder at Sunbeam Dam. Though the ladder was inadequate at certain flows, he claims that a few sockeye and chinook always got through. He recalls hundred's of sockeye spawning in Redfish Lake during an outing with his friend Ted Williams during 1948.

(Bill James, Personal Communication, Challis, ID)

Mr. James recalls the sockeye salmon spawning in good numbers in 1947 at Redfish Lake.

(Hauck, 1955)

In 1942, the first account of the return of sockeye salmon to the Stanley Basin was made by a survey team of the U.S. Fish and Wildlife Service since the partial removal of Sunbeam Dam in 1934. The USFWS observed about 200 spawning sockeye in Redfish Lake. Leland Hoopes of Stanley reported fairly large numbers of sockeye in October of 1951 and 1952. In 1953, sockeye were also observed in the Salmon River below Stanley, and a survey of Redfish Lake in October gave an estimated spawning population of about 2-3 thousand fish.

(Mallet, 1974)

Sockeye salmon reportedly once used the South Fork Salmon R., but have not been seen during extensive spawning ground surveys since 1955.

(Bjornn et al, 1968)

Fish found in Pettit and Yellowbelly Lakes, after chemical treatment in 1961 and 1962, appeared to be residual sockeye salmon. The fish were darker in coloration than the bright red kokanee and would have spawned later than the kokanee populations in Redfish and Alturas Lakes. Bjornn et al (1968) found no record of kokanee being planted in either Pettit or Yellowbelly Lakes.

From 1954-1966, adult sockeye were enumerated at the Redfish Lake Creek weir. A temporary weir was installed in Redfish Lake Creek in 1954 for the enumeration of adult sockeye. A permanent two-way weir (Craddock, 1958) was installed in the spring of 1955 and both smolts and adults were enumerated in 1955 and subsequent years by personnel of the Idaho Department of Fish and Game and U.S. Bureau of Commercial Fisheries. Numbers of returning adults ranged from 11 in 1961 to 4,361 in 1955 (Table below):

<u>Year</u>	<u>Number of Adult Sockeye counted</u>
1954	998
1955	4,361
1956	1,381
1957	523
1958	55
1959	290
1960	75
1961	11
1962	39
1963	395
1964	335

Adult sockeye salmon migration upstream to Redfish Lake were captured in an adult trap in the center of the weir, and then counted out of the trap over a counting board except for those sampled for sex and length. Adults usually appeared at the weir after the middle of July and most of the run was passed during August. Approximately 10% of the run passed the weir during early September. Spawning took place on the beach areas of Redfish Lake during October with the peak of activity about the middle of the month. Fork length of most sockeye salmon measured at the Redfish Lake Creek weir during the period 1953-1965 ranged from 19.0 to 25.0 inches (483-635 cm). The mean length of females was approximately 21.5 inches (546 cm) and males averaged 22.7 inches (577 cm). Redfish Lake sockeye salmon usually spent two years at sea and returned in their fourth or fifth year of life.

Kenneth Mosher (Bjornn et al 1968) collected otoliths from 24 Redfish Lake sockeye salmon in 1953 for age determination. Of the 24 otoliths examined by Mosher, 21 of the fish had spent 2 winters at sea and ranged in length from 20.2 (513 cm) to 24.7 inches (627 cm), 2 had spent three winters at sea and were both 23.5 inches (597 cm) in length, and 1 had spent one winter

at sea and was 17.5 inches (445 cm) long.

Sex ratio in the spawning run enumerated at the Redfish Lake Creek weir was virtually 1:1 for all fish sampled during the years 1953-65.

Juvenile sockeye sampling occurred from late April through May during 1955-1966 at the Redfish Lake Creek weir. Downstream migrants were captured in inclined plane traps at the Redfish Lake Creek weir, which strained all of the the flow from the creek. The traps were checked periodically and fish removed as necessary. Fish were counted individually when small numbers were caught, but when large numbers were captured the entire catch was weighed and samples were taken to determine the number per pound and total catch. Random samples of 10-20 fish were measured and weighed alive each day and scales removed for age determination. The number of smolts migrating from Redfish Lake during this 12 year period ranged from 2,133 smolts in 1960 to an estimated total migration of 65,000 in 1957.

(Idaho Department of Fish and Game file, 1978)

Memo dated Feb. 6, 1979 from Kent Ball to Paul Jeppson:  
1978 - 167 sockeye were enumerated past Lower Granite Dam.  
IDFG personnel were unable to find any sockeye on the spawning grounds in Redfish Lake.

(Idaho Department of Fish and Game, Annual Reports of Smolt Condition and Timing of Arrival at Lower Granite Reservoir, 1983-1989 )

The following table contains information on the number of sockeye smolts collected by IDFG personnel conducting the smolt monitoring project on the Salmon and Snake Rivers:

YEAR	NUMBER OF SOCKEYE SMOLTS COLLECTED		REFERENCE
	SALMON R. TRAP AT WHITEBIRD	SNAKE R. TRAP AT LEWISTON-CLARKSTON	
1983	0	38	Scully et al, 1983
1984	3	49	Scully & Buettner, 1984
1985	7	90	Scully & Buettner, 1985
1986	not operated	224	Buettner & Nelson, 1987
1987	0	5	Buettner & Nelson, 1988
1988	0	3	Buettner & Nelson, 1989
1989	not operated	331	Buettner & Nelson, 1990
1990	-	334	(Buettner, Pers. Comm)

(Koski et al, 1990)

Juvenile salmon and steelhead have been collected, bypassed and transported at Lower Granite Dam smolt collection facility since 1982. During the past 8 years of operation, downstream migrant sockeye numbers have ranged from 791 in 1987 to 14,045 in 1989. The 1989 count was up substantially (86.4%) from the 1,903 juveniles estimated during the previous season. Many believe, however, that the majority of these fish were actually kokanee that escaped from Dworshak Reservoir during periods of high discharge.

(U.S. Army Engineer District, 1988)

Adult sockeye passing Bonneville Dam on the Columbia River have been counted since 1938. Counts have ranged from 9,501 in 1945 to 237,748 in 1955. The 10-year average of sockeye escapement over Bonneville Dam is 89,202. The 10-year average for sockeye passing Lower Granite Dam is 82. Counts of adult sockeye escapement over Lower Granite Dam have been made since 1975, and have ranged from 531 in 1976 to 15 in 1986. In 1988, 23 sockeye crossed Lower Granite Dam, and a record low of 2 adult sockeye was set in 1989 (IDFG files).

(Hall-Griswold and Cochnauer, 1986, Feb. 1988, April 1988)

A temporary weir was placed in Redfish Lake Creek to count sockeye salmon entering Redfish Lake during periods of adult escapement during 1985 - 1987. Ground counts of redds in Redfish Lake were conducted from 1981 to 1988. Adult escapement and redd counts for the period 1981-1989 have been compiled in the following tables:

Table A. Adult Sockeye escapement to Redfish Lake 1981-1989

( ) Number of adult sockeye trapped at the Sawtooth Trap

YEAR	WEIR OPERATION	NUMBER SOCKEYE COLLECTED		LUMBER SOCKEYE PASSED		NUMBER SPAWNED ARTIFICIAL		NUMBER EGGS COLLECTED	REFEREN. (Tbl.B)
		M	F	M	F	M	F		
1981	-----	No weir	at	RedfishLake	Creek	-----			2
1982	-----	No weir	at	RedfishLake	Cre <sup>e</sup> k	-----			2
1983	-----	No weir	at	RedfishLake	Creek	-----			2
1984	-----	*No weir	at	RedfishLake	Creek	-----			2
1985	7/10-10/9	9(2)	2(1)	10	2	1	1	2,900	7(8)
1986	7/20-9/15	7	22	0	0	3	13	31,594	9
1987	6/5-9/29	7	9	7	9	0	0	--	10
1988	--	(1)	0	1	0	--	--	--	11
1989	--	0	(1)	0	1	--	--	--	12

\*One adult sockeye trapped at Sawtooth & passed upstream on main Salmon River to continue upstream migration.

Table B. Redfish Lake spawning ground surveys from 1981 - 1988.

YEAR	DATES OF SURVEY	NUMBER OF ADULTS	NUMBER OF REDDS	REFERENCE
1977		0	0	1
1978		0	0	1
1979		0	0	1
1980		0	0	1
1981	9/15,22,29 & 10/6,13,21	21 MALE 5 FEMALE	0	3
1982	10/5,13,19	50	25	4
1983	OCT.	0	0	5
1984	OCT. 11	16	11	6
1985	SEPT./OCT.	0	0	7
1986	2 SURVEYS	0	0	9
1987	9/17,28;10/8,20	0	1 potential	10
1988	9/24;10/8,29	2 MALE 2 FEMALE	2	11
1989	OCT.(2 surveys)	0	1 and 1 potential	12

1. Kent Ball, IDFG, Personal Communication
2. Tom Rogers, IDFG, Personal Communication
3. Pollard et al, Sept. 1982
4. Pollard, Feb. 1983
5. Pollard, H., Aug. 1984
6. Pollard, H., April 1985
7. Hall-Griswold & Cochnauer, 1986
8. Gary Gadwa, C.O. Stanley, IDFG, Personal Communication
9. Hall-Griswold & Cochnauer, Feb. 1988 Hall-Griswold &
10. Cochnauer, Apr. 1988 White & Cochnauer, June 1989
11. Phil Coonts, IDFG, Personal Communication



## 2. Juvenile migration characteristics of natural populations of sockeye in the Salmon River Basin.

(Bjornn et al, 1968)

Sockeye salmon smolt migration was monitored from 1955-1966 at the Redfish Lake Creek weir. Sockeye salmon smolts migrated from Redfish Lake primarily from 1800 to 2400 hr. There was no consistent relationship between seasonal timing of the migration, lake ice cover, temperatures or flow of the outlet stream. The role of photoperiod in timing of the migration and the parr-smolt transformation is unclear. Seaward migrant sockeye salmon departed from Redfish Lake from late April through May during the years 1955-1966. The dates when largest numbers of fish left the lake during those years mentioned, ranged from 3 to 18 May. In most years, a majority of the fish migrated during the first 3 weeks of May. Migration of smolts usually coincided with increasing flows, but there were years, such as the 1961 peak, when a large number of fish migrated before any increase in stream flow had occurred.

The main downstream movement of fish in Redfish Lake Creek did not start until shortly after dark, peaked about 2230 or 2300 hr. and then decreased. Seventy-six percent of the migrants were captured between 1800 and 2400 hr., 21% between 2400 and 0600 hr., and only 3 % in the combined period of 0600 to 1800 hr. Young sockeye migrants moved during hours of darkness. Large schools of fish were often seen entering the weir pond just at dusk, and were observed spilling into the traps in groups rather than singly, indicating schooling behavior after dark.

Estimated and actual counts of juvenile sockeye salmon migrating from Redfish Lake ranged from 2,133 to 65,000 during the years 1955-1966. Estimates of the total number of migrants were made by examination of the histogram of daily catches and subjective extrapolation of the daily catch curve for parts of the run missed (ie., 1955-1961 trapping was not initiated until after the migration had begun). In 1957, trapping was discontinued due to high stream flows. In other years trapping was discontinued before the entire migration had been counted, but Bjornn et al (1968) believed that only a small part of the run was missed based on the trend of daily catches.

Growth of sockeye salmon in Redfish Lake varied annually, appearing to be related at least partially to density of fish in the lake. Sockeye salmon migrated

from Redfish Lake at the beginning of their second or third summer of life.

There was a relationship between the age at which juvenile sockeye salmon migrated from Redfish Lake and their growth during their first summer in the lake. The percentage of a year class migrating as yearlings was not closely correlated with the total number of eventual migrants (all smolts of a year class plus age II smolts of previous year class) in the lake during the first summer of life of the yearling migrants.

(Bowles and Cochnauer, 1984)

Redfish Lake smolts migrate approximately 1,440 river kilometers (rkm) to the ocean. Some smolts are presently transported by truck or barge around lower Snake and Columbia River Dams.

(Welsh et al, 1965)

Table 5. Downstream migrant sockeye counts at the Redfish Lake Creek weir, 1954-1966.

<u>YEAR</u>	<u>5MOLTS</u>
1954	--
1955	48,720
1956	40,000
1957	32,857
1958	38,000
1959	12,324
1960	2,113
1961	19,857
1962	23,358
1963	23,320
1964	6,492
1965	18,479
1966	15,159

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3. Records of sockeye supplementation (stocking) in the Salmon River Basin.

a. origin and destination of donor stock (eggs, juveniles and adults)

(Idaho Department of Fish and Game, Fish Stocking Records, IDFG Library, Boise, ID)

YEAR	ORIGIN OF DONOR STOCK	LIFE STAGE	DESTINATION
1921	-	yearling	Alturas Lake
1935	-	2"	Payette Lake Tribs.
1935	-	2-4"	Rapid Creek
1936	Evergreen Hatchery	-	Payette Lake Tribs.
1936	Evergreen Hatchery	-	Payette Lake Tribs.
1936	Evergreen Hatchery	-	Payette Lake Tribs.
1937	Evergreen Hatchery	-	Fisher Cr.- McCall
1937	Evergreen Hatchery	-	Fall Cr.
1937	Evergreen Hatchery	-	Cougar Cr.
1937	Evergreen Hatchery	-	N. Fk. Payette
1937	Evergreen Hatchery	-	Deep Cr.
1937	Evergreen Hatchery	-	Fisher Cr.
1937	Evergreen Hatchery	-	N. Fk. Payette
1938	Coeur d' Alene Hatchery	-	Coeur d' Alene Lake
1938	Coeur d' Alene Hatchery	-	Coeur d' Alene Lake
1938	Coeur d' Alene Hatchery	-	Spirit Lake
1938	Evergreen Hatchery	-	N. Fk. Payette
1938	Evergreen Hatchery	-	Fall Cr.
1938	Evergreen Hatchery	-	N. Fk. Payette River
1938	Evergreen Hatchery	-	Warm Lake

(Tom Rogers, IDFG Personal Communication)

YEAR	ORIGIN	LIFESTAGE	DESTINATION
1980	Babine Lake, B.C.	eyed eggs	Stanley Lake, ID
1981	Babine Lake, B.C.	eyed eggs	Stanley Lake, ID
1982	Babine Lake, B.C.	eyed eggs	Stanley Lake, ID
			Alturas Lake, ID
1983	Babine Lake, B.C.	eyed eggs	Stanley Lake, ID
			Alturas Lake, ID

(Bowles & Cochnauer, 1984)

Donor stock - Sockeye salmon fry from Babine Lake on the Skeena River system is currently used to seed Stanley Lake.

b. quantity

(Parrish 83, 84)

Alturas Lake - 1,400 fry per hectare stocked in 1983.

(Idaho Department of Fish and Game, Fish Stocking Records,  
IDFG)

NO. FRY STOCKED	STOCKING DATE	STOCKING LOCATION	REARING HATCHERY
40,300	6/19-8/2/21	Alturas Lake	-
25,000	5/21/35	Payette Lake Tribs	-
25,000	9/22/35	Rapid Cr.	-
98,000	5/29/36	Payette Lake Tribs	Evergreen
98,000	6/1/36	Payette Lake Tribs	Evergreen
40,000	6/2/36	Payette Lake Tribs	Evergreen
27,300	7/10/37	Fisher Gr.-'McCall	Evergreen
53,300	7/20/37	Fall Cr.	Evergreen
26,650	7/21/37	Cougar Cr.	Evergreen
26,000	7/21./37	N. Fk. Payette	Evergreen
32,000	7/22/37	Deep Cr.	Evergreen
32,600	7/22/37	Fisher Cr.	Evergreen
16,000	7/23/37	N. Fk. Payette	Evergreen
125,000	5/19/38	Coeur d' Alene Lk.	Coeur d'A
25,000	5/23/38	Coeur d' Alene Lk.	Coeur d'A
50,000	5/2:x/38	Spirit Lk.	Coeur d'A
98,000	6/21/38	N. Fk. Payette	Evergreen
98,000	6/22/38	Fall Cr.	Evergreen
50,800	6/22/38	N. Fk. Payette	Evergreen
25,000	7/21/38	Warm Lk.	Evergreen

(Howell et al, 1985)

Rearing and history for Mackay Hatchery sockeye, brood 1980 to 1983:							
Brood Year	Brood Stock	No. eyed eggs	No. fry stocked	Stocking date	Stocking No/lb	Stocking location	Hatchery rearing
1980	Babine Lk., B.C.	536,000	173,880	6/23/81	41.4	Stanley Lk	Amer.Fal
1981	Babine Lk., B.C.	604,350	260,393	6/24/82	48.9	Stanley Lk	Amer.Fal
1982	Babine Lk., B.C.	752,000	150,015	6/20/83	73.0	Stanley Lk	Mackay
			480,800	6/20/83	65.0	Alturas Lk	Mackay
1983	Babine Lk., B.C.	259,356	63,000	6/6/84	70.0	Alturas Lk	Mackay
			147,000	6/6/84	70.0	Stanley Lk	Mackay
1984	No fish collected this year due to IHN.						

effectiveness

(Tom Rogers, IDFG, Personal communication)

Babine Lake, B.C. (Fulton River) sockeye salmon stocks failed. No adult returns were observed .

life history characteristics of donor stock

(Bowles & Cochnauer, 1984)

Babine Lake stock of sockeye salmon from the Skeena River system are relatively disease free, but exhibits tributary spawning tendencies, and typically migrates less than 640 river kilometers (Parrish, IDFG pers. comm., Foerster 1968)

(Kent Hauck, IDFG Fish Pathologist, Eagle Lab)

Disease history of Babine Lake sockeye raised at American Falls Ha.tchery:(Note: no disease history for sockeye raised at Mackay Hatchery)

CASE	DATE	BROOD	FISH	STOCK	SEECIES	FINDINGS	REMARKS
AF-1-91	1/7/81	'80	fry	Babine Lake,BC	Sockeye salmon	Coag.yolk + BGD	Increasing loss.Salt or KMN04
AF-12-81	3/6/81	'80	fry	Babine Lake,BC	Sockeye salmon	Sys.Bact. & BGD	200/day los Std.flush for 3 days. If not im-proved, then TM feed for 14 days. Much improved.
AF-14-81	4/2/81	'80	fry	Babine Lake,BC	Sockeye salmon	BGD	159,700 los Cutrine + 4x flushes. Good result
AF-2-82	4/1/82	'81	fry	Babine Lake,BC	Sockeye salmon	Sys.Bact.	50/day loss TM feed for 10-14 days.
AF-4-82	5/20/82		'81	Babine Lake,BC	Sockeye salmon	Coldwater disease & BGD	2000/day/rw loss. Salt @ 1 1/2% & 4X. TM feed for 10 days

(Idaho Department of Fish & Game file)  
 Babine Lake and River sockeye stock disease history:

<u>CASE</u>	<u>DATE</u>	<u>SPECIES</u>	<u>SRCE.</u>	<u>DIAGNOSIS</u>
792970	9-18-79	sockeye salmon	wild	Diphylllobothr.
792970	9-18-79		wild	furunculosis
792970	9-18-79		wild	Philonema
781590	6-14-78		wild	IHN
771320	5-28-77		cult	IHN
770990	5-24-77		cult	IHN
761960	9-22-76		wild	IHN
761080	6-18-76		cult	Eubothrium
761080	6-18-76		cult	Myxobact. Dis.
761080	6-18-76		cult	Philonema
751590	9-9-75		wild	IHN
900840	7-28-70		cult	Myxobact. Dis.

4. Records of sockeye (eggs, juveniles, adults) shipments to areas outside the Salmon river Basin.

(Tom Rogers, IDFG, Personal Communication)  
 No sockeye were shipped out of the Salmon River Basin.

5. Evidence of sockeye escapement above and below Sunbeam Dam between 1919 and 1934.

a. observations of adult passage

(Locke 1929)  
 Locke (1929) reported adult kokanee or residual sockeye salmon in Redfish and Alturas Lakes. These fish averaged about 11" long and weighed 1/2 lb. Sockeye were occasionally found below Sunbeam Dam averaged 4-7 lbs.

(Marie Sullivan, Personal Communication, Challis, ID)  
 Mrs. Sullivan was born in 1919 in Stanley, ID and lived there for 30 years. She recalls her father taking her to the Sunbeam Dam when she was a young girl to watch the sockeye and chinook salmon jump at the base of the dam trying to negotiate the fish ladder. Not all the fish were successful, but many did make it up the ladder. She remembers sockeye returning every year as a young child in the 1920"s and 1930"s (during the time when Sunbeam Dam was in operation), and observing the sockeye in September and October when they were spawning in Redfish Lake.

(Nellie Lenier, Personal Communication, Challis, ID)

Nellie Lenier was born in Stanley, ID in 1912, and lived there for 36 years. She recalls seeing sockeye salmon above the Sunbeam Dam in the main Salmon River while the dam was in operation.

b. harvest (recreational, commercial, tribal)

(Marie Sullivan, Personal Communication, Challis, ID)

Mrs. Sullivan never harvested sockeye, or knew of anyone harvesting sockeye, however, in 1933, she and her brother speared 7 chinook salmon from Decker Creek at Decker Flats. This was the first time salmon had been seen in Decker Creek, and also became evidence that salmon were negotiating the Sunbeam Dam.

(Morgan Williams, Personal Communication, Challis, ID)

Mr. Williams said that he could not recall anyone actually fishing for sockeye, though some chinook were speared. Even the Indians, that would come to their ranch to tan deer hides each year, did not fish during the early 1930"s.

c. spawning ground surveys

(Marie Sullivan, Personal Communication, Challis, ID)

In 1927, Mrs. Sullivan recalls watching the large sockeye salmon spawn along the shoreline of Redfish Lake in October. She says the sockeye came back every year to spawn in Redfish Lake. In 1932 her teacher took her class on a field trip to Redfish Lake to observe the sockeye spawning. She recalls 100"s of sockeye spawning in the lake.

(Phyllis Williams, Personal Communication, Challis, ID)

Phyllis Williams moved to Stanley in 1933 when she married a local rancher. She recalls observing adult sockeye salmon spawning in Redfish Lake in October of that year.

(Morgan Williams, Personal Communication, Challis, ID)

Mr. Williams was born in 1922 in Stanley, and remembers the sockeye salmon returning to Redfish Lake as a small boy. When he was in the 3rd grade (approximately 1930) his teacher took the class to the lake to watch the sockeye spawn along the shore. He said there were hundreds of sockeye.

6. Historical records of kokanee distribution and abundance in the Salmon River Basin.

a. observations

(Bjornn et al, 1968)

In 1961, observations were made at Fish Hook Creek, the only Redfish Lake tributary used for spawning, to determine if spawning kokanee were present. No fish were observed. During 1955-1966, Bjornn et al (1968) did not observe kokanee and/or residual sockeye salmon spawning on the shoreline spawning areas in Redfish Lake, but observations were limited.

(Evermann, 1895)

Evermann observed nonanadromous forms of sockeye (kokanee) during his visit to the lakes of the Stanley Basin in 1884 and 1885.

(Locke, 1929)

Locke (1929) reported kokanee or residual sockeye salmon in Redfish and Alturas Lakes at a time when searun sockeye salmon could not get upstream past Sunbeam Dam.

b. harvest

(Davis, 1987)

Davis conducted a creel census at Redfish, Stanley, Alturas and Pettit Lakes in 1986. The results of the number of kokanee in the creel are listed below:

Total estimated Creel Summary Kokanee harvest					
<u>LAKE</u>	<u>DATE</u>	<u>NO.</u>	<u>C/R</u>	<u>BOAT</u>	<u>BANK</u>
Redfish	5/24-9/1/86	94	0.06	692	229
Stanley	5/24-9/1/86	148	0.1	477	517
Alturas	5/24-9/1/86	6	0.005	30	34
Pettit (Kokanee were harvested, but no figures given)					

(Davis, 1988)

A creel census was conducted at Redfish and Alturas Lakes in 1987. The results of the number of kokanee in the creel are listed below:

Total estimated Creel Summary Kokanee harvest					
<u>LAKE</u>	<u>DATE</u>	<u>NO.</u>	<u>C/R</u>	<u>BOAT</u>	<u>BANK</u>
Redfish	5/23-9/7/87	212	0.2	1,869	9
Alturas	5/23-9/7/u7	22	0.01	79	71



c. surveys (spawning ground, juvenile and adult sampling)

(Rodeheffer, 1935)

Approximately 500-600 kokanee were observed spawning during the second week of August (1934) in inlet of Stanley Lake. These fish were reported to be about 8-9" long.

(Davis, 1987)

Kokanee were observed in Redfish and Alturas Lakes in 1986, but were not caught in gill net sets during June. However, kokanee were seen in gill net samples taken in Stanley and Pettit Lakes in June and October of 1986.

(Idaho Department of Fish and Game Files, Memorandum from James C. Simpson, dated Aug. 24, 1960)

Kokanee scale samples were taken in June (from Stanley Basin Lakes). Age group <sup>T</sup> kokanee had laid down their first annulus in June; these fish were 3.3 inches long. Age group II kokanee showed distinct new annuli and ranged from 5.7 to 7.1 inches in length, averaging 6.4 inches. Age group III were just forming an annulus on the edge and ranged from 8.0 to 8.8 inches, averaging 8.4 inches. Age group IV had not yet formed an annulus (probably because growth in length is progressively slower on older fish); they ranged from 8.8 to 10.0 inches, averaging 9.5 inches.

7. Records of kokanee supplementation (stocking) into the Salmon River Basin.

- a. origin and destination of donor stock (eggs, juveniles, or adults)

(Idaho Department of Fish and Game, Fish Stocking Records)

<u>YEAR</u>	<u>ORIGIN</u>	<u>DONOR</u>	<u>LIFESTAGE</u>	<u>DESTINATION</u>
1921	Hayspur Hatchery		yearlings	Streams of Sawtooth Mountains
1922				U. Champion Lk.
1922				U. Champion Lk.
1922				Payette Lake
1962	Anderson Ranch Res.			Redfish Lake
1966	Anderson Ranch Res.			Alturas Lake
1968	Anderson Ranch Res.		fry	Pettit Lake
	Anderson Ranch Res.		fry	Alturas Lake
1971	Anderson Ranch Res.		fry	Fishhook Creek
	Anderson Ranch Res.		fry	Redfish Lake
1972	Anderson Ranch Res.		3-6"	Redfish Lake
1988	Deadwood Reservoir		3-6"	Stanley Lake
1989	Deadwood Reservoir		3-6"	Stanley Lake

(Jim Simpson, Personal Communication)

Mr. Simpson recalls that the origin of the kokanee in Anderson Ranch Reservoir was Pend d'Oreille Lake. The Pend d'Oreille Lake kokanee originated in Flathead Lake, MT.

(Evan Parrish, Personal Communication)

Mr. Parrish believes that the origin of the kokanee in Deadwood Reservoir was from Redfish Lake sockeye salmon during an egg taking program in the 1950's. The eggs supposedly were raised at Mackay Hatchery and fry were planted in Deadwood Reservoir.

(Rodeheffer, 1935)

Rodeheffer reported that numerous plantings of landlocked sockeye had been made to Stanley Lake with no apparent results (pre-1935).

b. quantity (Idaho Department of Fish and Game, Fish Stocking Records)

Date Planted	Size at Planting	No. kokanee stocked	Lbs. fish planted	Stocking location	Rearing Hatchery
6/19-8/2/21	Yr.	15,000		Streams of Sawtooth Mts.	Hayspur
9/3/22		1,500		U.Champion Lk.	
9/7/22		500		U.Champion Lk.	
8/18/22		15,750		Payette Lk.	
*1923		1,000		Stanley Lk.	
7/13/62		43,251	110.5	Redfish Lk.	Mackay
7/8/66		59,332	202.5	Alturas Lk.	Mackay
6/26/68	< 3"	196,000	280.0	Alturas Lk.	Eagle
6/28/68	< 3"	79,100	113.0	Pettit Lk.	Eagle
5/28/71	< 3"	50,344	434.0	Fishhook Cr.	
6/17/71	< 3"	45,900	450.0	Redfish Lk.	
7/12/72	3-6"	51,435	635.0	Redfish Lk.	
6/1/88	3-6"	49,926	570.0	Stanley Lk.	
5/15/89	3-6"	60,000	1,000.0	Stanley Lk.-	

\*Rodeheffer, 1935

(Bjornn et al., 1968)

July 1962, 42,900 kokanee fingerlings of the 1961 year class were released into Redfish Lake.

Bjornn et al (1968) found no record of kokanee being planted in either Pettit or Yellowbelly Lakes.

c. effectiveness

(Tom Rogers, IDFG, personal communication)

No evaluations of kokanee stocking programs have been conducted.

(Rodeheffer, 1935)

Reported that before 1935, numerous plantings of land-locked sockeye had been made to Stanley Lake, with no apparent results.

8. Records of kokanee (eggs, juveniles, adults) shipments to areas outside the Salmon River Basin.

(Tom Rogers, IDFG, Personal Communication)

No kokanee shipments have been made out of the Salmon River Basin.

9. Life history characteristics of natural kokanee populations in the Salmon River Basin and donor stocks

a. spatial (lake or stream and temporal reproductive characteristics

b. incidence of interbreeding with sockeye

(Bruce Rieman, IDFG, Personal Communication)

No electrophoretic data on Stanley Basin sockeye, however, some information exists for sockeye and kokanee from other systems outside of Idaho.

c. incidence of anadromy in the population

(Bjornn et al, 1968)

The survival of juvenile sockeye in Redfish Lake from potential egg deposition to smolt migration was unusually variable. For the year classes in which less than 100,000 eggs were deposited the smolts enumerated comprised about 2 to 144% of the potential egg deposition.

The survival percentage of 144 for the 1961 year class was evidence that sockeye salmon smolts from Redfish Lake may originate from kokanee and/or residual sockeye salmon as well as the usual sea-run form of adult. There were more 1961 year class smolts enumerated than sea-run sockeye eggs available for deposition.

Kokanee stocked in 1962, from the 1961 year class, could have migrated from the lake during the spring of 1963 as yearlings along with the 1961 year class sockeye salmon offspring. The recovery of four marked kokanee (6,825 marked before release with a right ventral fin-clip) among 6,209 smolts examined in the spring of 1963 was an indication that few of the planted kokanee migrated from the lake.

In 1964, 45 fish which had evidently been to the ocean

(based on their larger size) returned to Alturas Lake and were observed in the outlet and inlet streams to the lake. These sea-run fish spawned in the same inlet stream and at the same time (late August) as the kokanee; thus Bjornn et al (1968) believed that they were kokanee which had gone to sea and returned. Redfish Lake sea-run sockeye salmon spawn on the lake shores during October.

(Russ Kiefer, 1990, personal communication)

In 1990, IDFG personnel captured 507 sockeye and PIT tagged 393 of them in the upper Salmon River (above Sawtooth Hatchery weir). The origin of these fish was probably Alturas Lake. The first PIT tagged fish was interrogated at Lower Granite Dam on 5-19-90. Thirty one fish have been interrogated to date (6-1-90), and their average travel time from the upper Salmon River to Lower Granite Dam was 15 days. The sockeye salmon ranged in length from 80.0 - 127.0 mm (FL), with a mean length of 94.0 mm.

10. Characterize historical to present habitat features in Redfish, Alturas, Stanley, Pettit and Yellowbelly Lakes and their tributaries

a. lake productivity

(Casey & Webb, 1960)

Redfish Lake is characterized as Oligotrophic. Total dissolved solids were <60 ppm.

(Bowles & Cochnauer, 1984)

Redfish and Alturas Lakes are classified as Oligotrophic.

b. water quality and quantity (including fluctuations in water elevation

(Rodeheffer, 1935)

Stanley Lake was surveyed in 1934 during the first week of July. Surface water temperature was 57.9 F. The thermocline extended between the depths of 25 and 35 feet. A secchi disc reading of 30 feet indicated relatively few microscopic organisms above the thermocline. Stanley Lake has an approximate area of 136 acres, and maximum depth of 90 feet. Dissolved oxygen was 7.9 ppm at the surface and 6.5 ppm at 60 feet. The lake is slightly acidic with a pH of 6.8. The inlet to Stanley Lake had a volume flow of 15.7 cfs. The outlet had a volume flow of 25 cfs.

(Webb et.al., 1961)

In 1960, the IDFG conducted a general investigation in water quality. Below are the water quality data for Redfish, Alturas, Stanley and Pettit Lakes:

	Redfish	<u>Alturas,</u>	Pettit	Stanley
Total dissolved salts	<60	<60	<60	<60
pH	7.55	6.8	6.8	7.0
Ca	3.8	8.0	5.0	8.0
Mg	.61	1.0	3.4	1.9
Na	1.84	1.0	1.0	2.0
K	.39	-	-	-
CO <sub>3</sub>	0	0	0	0
HCO <sub>3</sub>	15.25	40.0	20.0	28.0
Cl	3.55	11.0	8.0	10.0
SO <sub>4</sub>	trace	0	0	31.2
NO <sub>3</sub>	.02	0	0	0
Total P	.02	*0	*0	*0
Total Alkalinity	17.1	40	20	28
Dissolved Oxygen (ppm)				
5 feet		7.2	7.8	7.4
35 feet		-	-	7.5
50 feet		9.0	8.6	-
Total Hardness (ppm)		34.2	17.1	34.2
Water Temperature (F)				
Surface		64.0	70.0	65.0
5 feet		-	70.0	65.0
25 feet		58.0	56.0	-
35 feet		-	-	52.0
50 feet		50.0	48.0	-
75 feet		47.0	46.0	42.0
125 feet		45.0	46.0	-

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\*Phosphate Phosphorus

(Munther, 1975)

Munther (1975) measured streamflows below Alturas Diversion as related to percentage of usable stream width suitable for salmon passage, using standard Oregon method criteria of .8" and .6" minimum depth.

(Bjornn et al 1968)

Bjornn et al (1968) has water temperature and stream flow information for Redfish Lake Creek from 1958 to 1966.

(Bowles & Cochnauer, 1984)

Report morphological and limnological characteristics of Redfish and Alturas Lakes for 1983 (from Milligan et al. 1983).

Redfish Lake has an area of 610 ha, and a mean depth of 50 m. The lake lies at an elevation of 1996 m and is approximately 1450 river kilometers from the ocean. Mean summer temperature is 18.0 C. Total P (ug/l) is 6.0, and NO3-N (ug/l) is 40. Alkalinity is 7.7 mg/l and MEI is 0.6.

Alturas Lake, is much more productive than Redfish Lake, however, both are classified as Oligotrophic. Alturas Lake has an MEI of 1.7, Total P (ug/l) of 9.0, and NO3-N (ug/l) of 40. The area is smaller than Redfish Lake, at 334 ha, and has a mean depth of 28 m. Lake elevation for Alturas Lake is at 2140 m and lies 1480 river kilometers from the ocean.

(Idaho Department of Fish and Game, file dated 8/23/78)  
Yellowbelly Lake has a total surface area of 82.2 ha, and lies at an elevation of 2151.1 m. It has a maximum depth of 22.7 m, and a shoreline length of 5.2 km. Surface temperature in August was 15.0 C, and bottom temperature was 8.0 C. Secchi Disc measured 12.0 m. Alkalinity was 6.85 mg/l, Specific conductance was 25 umho/cm at 25 C, PH was 6.7 and Dissolved oxygen was 7.0 mg/l.

c, spawning substrate quality and quantity

(Rodeheffer, 1935)

In a survey conducted in 1934 by U.S. Forest Service personnel, the bottom of the inlet to Stanley Lake was composed of shifting gravel, which (as noted) makes ideal spawning grounds. The outlet of Stanley Lake has a bottom composed of gravel and rocks up to a foot in diameter.

(Welsh et. al., 1965)

An estimated 3 percent of Redfish Lake bottom is less than 20 feet in depth. The lake is the only presently known spawning area for sockeye salmon in the Snake River drainage.

(Petrosky & Holubetz, 1986)

Percent habitat type for sections of Alturas Lake Creek were measured above Alturas Lake, in 1984 and 1987. Section locations are shown in the FY1984 Report, Project 83-7. Petrosky (Personal Communication) summarizes the upper reach as essentially pristine and capable of supporting large numbers of sockeye, Chinook and steelhead spawners. The data are summarized below:

<u>Section</u>	<u>Channel</u>	<u>Mean</u>	<u>%</u>	<u>Pool: Mean Substrate Comp.(%)</u>					
<u>----</u>	<u>TV<sup>P</sup>e</u>	<u>Width</u>	<u>Gradient.</u>	<u>Riffle</u>	<u>Sand</u>	<u>Gravel</u>	<u>Rubble.</u>	<u>Boul.</u>	<u>Bed</u>
1A	C	7.5m	0.40	2.0:1	25.0	66.5	8.5	0	0
2A	C	7.2m	0.33	4.7:1	41.5	57.5	0.5	0	0

Sections were also sampled in the upper S. Fork Salmon River at Stolle Meadows in 1985 by Petrosky and HolubetE (1986).

d, describe and quantify development activities

11. Describe the design, location (maps), manner and period of operation, and date of initial operation for any diversions or barriers to fish passage in areas that have supported sockeye and kokanee populations in the Stanley Basin.

(Locke, 1929)

Sunbeam Dam, built in 1913 on the main Salmon River, approximately 20 miles downstream from the mouth of Redfish Lake Creek blocked fish passage. Attempts to construct fishways around Sunbeam Dam were never successful and sockeye salmon were reportedly unable to pass upstream.

(Bjornn et al, 1968)

The Sunbeam Dam was partially removed in 1934 to permit passage of salmon, however, no attempts were made to reestablish the sockeye salmon runs at this time.

(Munther, 1974)

Potential barriers to salmon migration into Alturas Lake include several irrigation diversions which are believed to be the main reason why sockeye salmon have not reestablished in Alturas Lake. The diversion (No. 17) is located on Forest Service land (T7N,R14E,Sec.4). On Valley Creek, there are no diversions below the mouth of Stanley Creek. However, during late summer, temperatures maybe adversely affected by low flows, in combination with high natural summer temperatures of Stanley Lake Creek.



(Petrosky & Holubetz, 1986)

Approximately 8 km upstream from the mouth of Alturas Lake Creek, an irrigation diversion dam (Figure 18) usually diverts all flow after the first week of July. The stream is dewatered for 2.6 km below this diversion. Sufficient flows for chinook spawning and rearing are provided to the lower portions of Alturas Lake Creek in most years by Vat Creek and subsurface flows. However, the diversion has eliminated a sockeye run which probably exceeded 4,500 in escapement at one time.

(Partridge, 1984)

Sawtooth Hatchery weir located on the main Salmon River, has been in operation since 1981. Sockeye heading to Alturas Lake must be passed above this weir.

(Fisher, 1977)

The Alturas Lake Creek Diversion is located 0.8 miles west of Hwy. 93, at MP 170. The road approaches the screen/diversion site to within about 100'. The screen size is 3' X 10' (5 units req.), and is powered by electricity.

(Idaho Department of Fish and Game, file) Physical Data on Yellowbelly and Stanley Lake Migration Barriers.

The barriers on Pettit, Yellowbelly, and Stanley Lakes are similar in design. The Stanley Lake barrier has 5 bays, each about 10' in width. The total between bunkers would be 54'. The water drops 4 feet onto an apron 6 feet long. The Yellowbelly Lake barrier has 6 bays, each about 8' in width. The total width between bunkers would be 53 feet. The water drops 5 feet onto an apron 6 feet long.

(John Lloyd, 1990, Personal Communication, USFS, SNRA) Currently, all the water in Alturas Lake Creek is diverted for irrigation. Set as a priority in 1990, the USFS is in the process of obtaining funds to redesign the Alturas Lake Creek diversion with a smaller headgate to allow a minimum flow of 14 cfs (requested by the SNRA), and screen all irrigation ditches.

12. Have spawning channels been implemented in Idaho for any species of anadromous fish and if so with what results?

(Kent Ball, IDFG, Personal Communication)

At present, there are no spawning channels for anadromous fish in Idaho.

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## Appendix A

Comparison of mean (and range) fork lengths taken of migrating sockeye salmon at Redfish Lake, in the main Salmon River at Stanley, ID and in the Snake River at Lewiston, ID.

(Bjornn et. al., 1968.)

Average fork length (mm) of yearling sockeye salmon migrating from Redfish Lake, 1954-1964:

1954	67.4
1955	76.7
1956	70.7
1957	87.7
1958	117.4
1959	105.4
1960	102.5
1961	93.3
1962	82.1
1963	87.5
1964	100.2

(Ed Buettner, IDFG, Personal Communication, 1990)

Average fork length (mm) and range of sockeye salmon collected at the Snake River smolt trap located at Lewiston, ID:

1990	83.3	(73.0-124.0)
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(Russ Kiefer, IDFG, Personal Communication, 1990)

Average fork length (mm) and range of sockeye salmon collected at the Salmon River trap located at Stanley, ID:

1990	94.0	(80.0-127.0)
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